



AFRL-RX-TY-TP-2010-0058

## **ROBOTIC RANGE CLEARANCE COMPETITION (R2C2) COMPETITION EVENTS & RULES**

---

Brian K. Skibba

Air Force Research Laboratory  
139 Barnes Drive, Suite 2  
Tyndall Air Force Base, FL 32403-5323

Contract No. FA4819-09-C-0044

MAY 2010

**DISTRIBUTION A:** Approved for public release; distribution unlimited.

### **AIR FORCE RESEARCH LABORATORY MATERIALS AND MANUFACTURING DIRECTORATE**

■ Air Force Materiel Command ■ United States Air Force ■ Tyndall Air Force Base, FL 32403-5323

<b>REPORT DOCUMENTATION PAGE</b>					<i>Form Approved OMB No. 0704-0188</i>							
The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.												
<b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b>												
<b>1. REPORT DATE (DD-MM-YYYY)</b> 26-MAY-2010		<b>2. REPORT TYPE</b> Presentation		<b>3. DATES COVERED (From - To)</b> 9-DEC-2009 - 31-OCT-2011								
<b>4. TITLE AND SUBTITLE</b> Robotic Range Clearance Competition (R2C2) Competition Events & Rules (Updated 26 May 2010) (BRIEFING SLIDES)				<b>5a. CONTRACT NUMBER</b> FA4819-09-C-0044								
				<b>5b. GRANT NUMBER</b> 								
				<b>5c. PROGRAM ELEMENT NUMBER</b> 99999F								
<b>6. AUTHOR(S)</b> Skibba, Brian K.				<b>5d. PROJECT NUMBER</b> R2C2								
				<b>5e. TASK NUMBER</b> F0								
				<b>5f. WORK UNIT NUMBER</b> QF503022								
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Air Force Research Laboratory 139 Barnes Drive, Suite 2 Tyndall Air Force Base, FL 32403-5323				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> 								
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Air Force Research Laboratory Materials and Manufacturing Directorate Airbase Technologies Division 139 Barnes Drive, Suite 2 Tyndall Air Force Base, FL 32403-5323				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> AFRL/RXQF								
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b> AFRL-RX-TY-TP-2010-0058								
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> Distribution Statement A: Approved for public release; distribution unlimited.												
<b>13. SUPPLEMENTARY NOTES</b> Ref AFRL/RXQ Public Affairs Case # 10-113. Document contains color images.												
<b>14. ABSTRACT</b> This presentation provides an overview of the events to take place in the Robotics Range Clearance Competition (R2C2), competitor steps to complete, SharePoint information, safety concerns, and In-Process Review (IPR) information. The competition will take place at the Joint Training and Experimentation Center, Camp Guernsey, Wyoming in the summer of 2011. This briefing will be distributed to the R2C2 competitors and posted on the SharePoint.												
<b>15. SUBJECT TERMS</b> R2C2, Robotic Range Clearance Competition, Office of Secretary of Defense (OSD), Camp Guernsey, active range clearance, Joint Ground Robotics Enterprise (JGRE)												
<b>16. SECURITY CLASSIFICATION OF:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; padding: 2px;">a. REPORT</td> <td style="width: 33%; padding: 2px;">b. ABSTRACT</td> <td style="width: 33%; padding: 2px;">c. THIS PAGE</td> </tr> <tr> <td style="text-align: center; padding: 2px;">U</td> <td style="text-align: center; padding: 2px;">U</td> <td style="text-align: center; padding: 2px;">U</td> </tr> </table>			a. REPORT	b. ABSTRACT	c. THIS PAGE	U	U	U	<b>17. LIMITATION OF ABSTRACT</b> UU		<b>18. NUMBER OF PAGES</b> 26	
a. REPORT	b. ABSTRACT	c. THIS PAGE										
U	U	U										
<b>19a. NAME OF RESPONSIBLE PERSON</b> Walter M. Waltz					<b>19b. TELEPHONE NUMBER (Include area code)</b> 							

Reset

# **R2C2 Competition Events & Rules**

**R2C2 Oversight Team  
26 May 10**

# Topics

---

- R2C2 Leadership
- Current Schedule of Events
- Steps to compete
- Competitor SharePoint Site
- Information Request Packet
- In-Process Review
- R2C2 Rules Document and FAQ

# R2C2 Leadership

---

- Jose Gonzalez, Deputy Director, Land Warfare & Munitions
- Robert Maline, Director, Joint Ground Robotics Enterprise
- Brian Skibba, Technical Manager, Robotics Range Clearance Competition
- Plyler McManus, Operations Manager, Robotic Range Clearance Competition

# Previous Documents

---

- All previously published R2C2 docs are still available on the [www.roboticrangeclearance.com](http://www.roboticrangeclearance.com) website.
- It is encouraged that those documents be reviewed. This will prevent R2C2 from reviewing old business.
- Be aware that portions of those documents are now obsolete.
- The current Rules and Metrics and Q&A are the driving documents.

# FY10 R2C2 Schedule

---

- Kick Off Event – complete
- Industry Day – complete
- Letters of Intent – complete
- Competitor Information Request Packet–  
due June 7th
- Pre-Trial Competitor Testing – at  
competitor request

# FY11 R2C2 Schedule

---

- Competitor In-Process Review – 1 to 19 November 2010
- Prize Competition Packets Issued – 90 days prior
- Prize Competition Packets Due – 45 days prior
- Prize Competition – Summer '11



# Steps to Compete

---

## 1. Form a team

- a. Sign Letter of Intent
- b. Receive access to team SharePoint

## 2. Submit Competitor Info Request Packet

- a. Choose competition categories
- b. Propose IPR location, request GFE, submit radio data

## 3. In-Process Review

- a. Host IPR
- b. Address any issues brought up by oversight team

## 4. Compete

- a. Submit Prize Competition Packet
- b. Pass radio spectrum test and safety demonstration
- c. Participate in Prize Competition

# Competitor SharePoint

- Your SharePoint account is being created based on the POC you will provide in the Comp. Info. Request Packet
- The SharePoint is the primary communication clearinghouse for the competition
- Up to two individuals may be given access per team
- The Competitor SharePoint has two parts:
  - An all competitor level that includes competition documents, the competition calendar, and question submission tool
  - A team folder that can only be accessed by your team and the competition oversight
- All prior competition documents will be posted in the documents library

# Information Request Packet

---

- Due June 7
- Choose IPR host location
- Category Registration is where teams choose all or some of the 4 competition categories to participate in.
  - They are Vegetation Removal, Surface Debris Clearance, Geophysical Mapping, Sub-surface Removal
  - This will allow us adequate time to resource, approve, and build the surrogate ranges for the qualification trial
- Request GFE if needed
- Provide preliminary radio data for each system planned for use
  - It is encouraged to provide DD1494s if available

# Radio Frequencies

- Camp Guernsey is a highly active DOD facility
- R2C2 is not a regulatory agency and makes no such claims
- Competitor systems RF signature will be captured during operations by spectrum analyzer
- Competitors will comply with all DOD and FCC regulations
- Frequencies in amateur that are generally open at Camp:
  - 219-220, 222-225 MHz
  - 420-450 MHz
  - 902-928 MHz
  - 1.24-1.3 GHz
  - 2.3-2.31 GHz
  - 2.39-2.45 GHz
  - 3.3 – 3.5 GHz

Frequencies prohibited due to military use:

2 to 50 MHz

138 to 144 MHz

148 to 149 MHz

163 to 168 MHz

227 to 293 MHz

328 to 419 MHz

# Pre-Trial Competitor Testing

- Any team that does not have access to adequate developmental test facilities may utilize Camp Guernsey with prior approval
- Packets will be posted on the SharePoint with all required information due 45 days before your requested test period
- This will be available on request
  - Camp Guernsey is highly active this training year so a little patience will be required
  - Limited or no billeting is available in this period
  - Please submit optional dates as your first choice may not be available
  - A list of available Camp Guernsey resources will be posted on the SharePoint

# In-Process Review

---

- 1 to 19 November 2010
- Location will be designated by competitor and agreed on by oversight
- Limited to one day at competitor site

# IPR Contents

---

- Technical Approach
  - How team's system will be employed
  - Level of autonomy pursued
  - Safety compliance
- Progress
  - Status of technical progress towards competition system
- Schedule
  - Developmental timeline
- Risks
  - Discussion of risks and mitigation strategies
- Demonstration of system (desired)

# Competition Packet

---

The competition packet will include at a minimum:

- Logistical support from R2C2 desired
- Composite Risk Matrix
  - a DOD standard tool that identifies hazards, describes mitigating procedures, and implements controls
- Radio spectrum information



# Competition Entry

---

- Upon arrival at the R2C2 Site at Camp Guernsey teams will undergo the following:
- RF Spectrum Test
  - With all systems and equipment operational a spectrum analyzer will be used to compare operating spectrum against a background
  - Any systems violating the unallowable frequencies given will not be allowed to compete until corrected
  - Any systems using frequencies not requested or with different operating characteristics that interfere with another system will not be allowed to compete until corrected
- Safety Demonstration
  - With all systems and equipment operational teams will undergo a safety demonstration in order to validate compliance with rules
  - Any systems violating the safety rules will not be allowed to compete until corrected
  - Any systems demonstrating activity not covered by Camp Guernsey approved Composite Risk Matrix will not be allowed to compete until hazards are properly mitigated and CRM updated and approved

# Competition Ranges

---

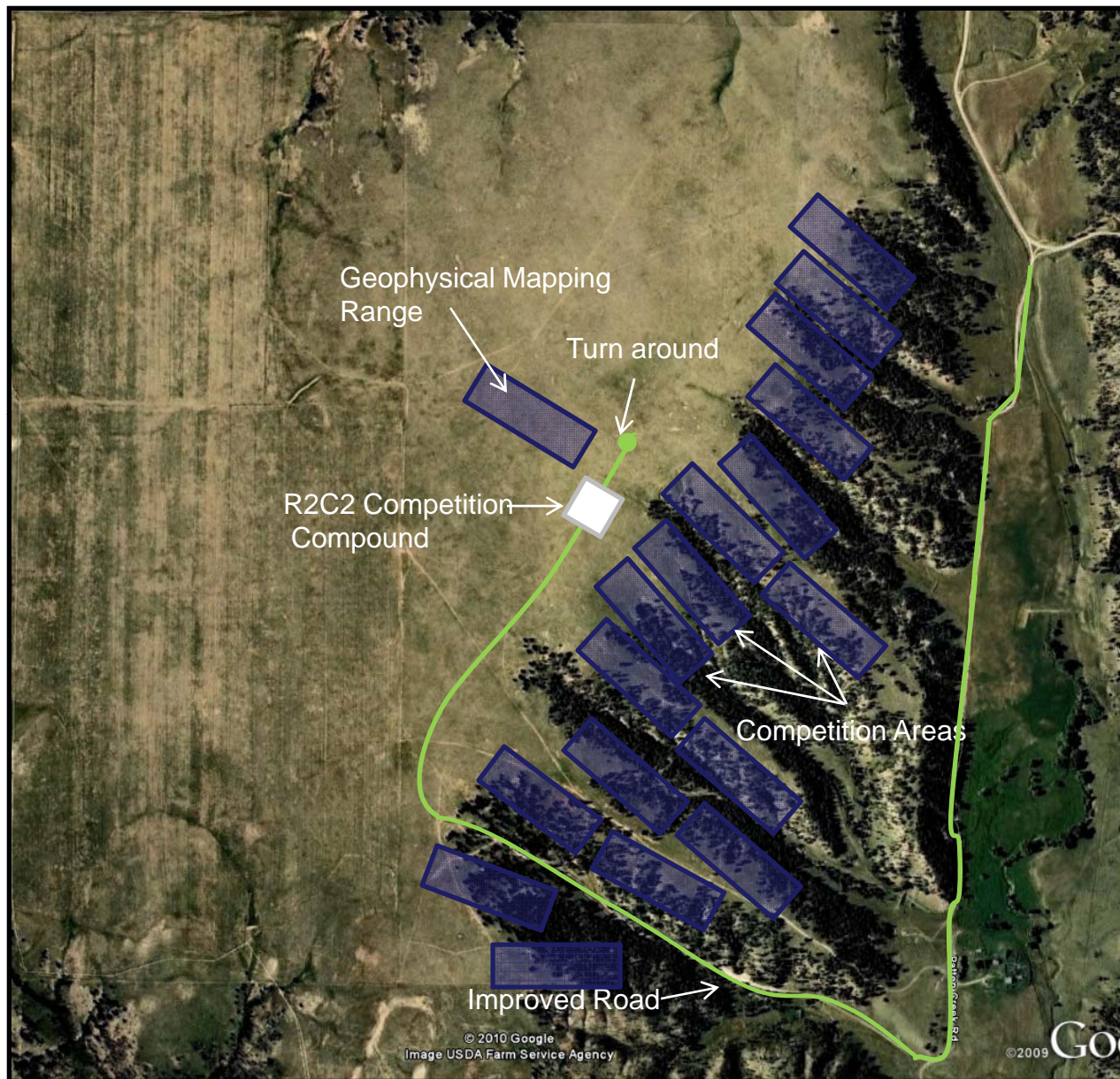
- There will be a single geophysical mapping range that all competitor teams will use for that task
- Each team will be issued a surrogate range for their other tasks
- Surrogate ranges for the prize competition may be as large as 50 acres, depending on the number of competitors choosing tasks other than geophysical mapping

# Location of Ranges

---

- Surrogate ranges will be fabricated in Camp Guernsey's North Training Area
- The sites have no history of munitions use. They will have been seeded with inert munitions, inert munitions debris, ISOs, and range related debris. SMEC items include inert 20mm TP up to inert 155mm projectiles. Munitions debris at the site consisted primarily of fragmentation, 81mm illumination mortars, and miscellaneous target debris
- Surrogate ranges will have vehicle targets placed on them as navigation hazards common to Army ranges

# R2C2 Competition Layout (tent.)



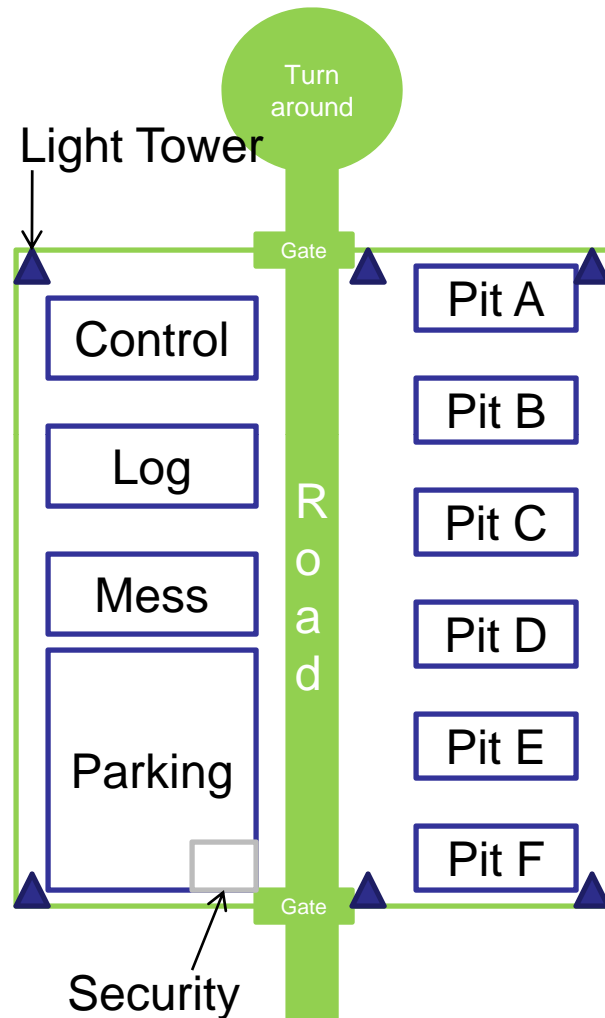
This is the area selected by Camp Guernsey for the competition. These competition areas are approximately 7 acres each as shown but will grow depending on Competitor Team task selection.

The road is under improvement to allow tractor trailer traffic to include turnaround.

The R2C2 Competition Compound is shown in the following slide.



# R2C2 Competition Compound (tent.)



The current compound layout calls for a chain link fence perimeter with two gates and a pull through road.

The main entry control point will have a security tent that will be manned by contract security after hours. Both gates and the compound will have cameras on them, eight in total (on hand).

Light trees will be located throughout the compound. A main generator will be brought in behind the logistics tent to provide 220v and 110v power throughout the compound.

Mess tent will have two hot meals per day and 24/7 coffee. Seating for 50 will be under cover inside the tent.

Each Pit tent will have parking in front for robots, all other parking will be in the designated area shown.

Log will have a full set of tools and maintenance equipment available for team support to include stick and wire feed welders. Spill kits and fire fighting equipment will be available here.

Comms is on hand and will operate out of control tent.

We are investigating a wireless camera array to cover active competition areas using our 32 channel DVR (on hand).

We anticipate leasing two passenger vans and six ½ ton pickup trucks to supplement JTEC vehicles. Each team will be assigned a pickup for the competition. The rest will be operated by R2C2.

# Rules

---

- The rules are intended to promote the widest variety of technical solutions
- The competition is being put together to represent active range clearance prior to new range construction on an Army facility
- Safety is the number one priority

# Rules Changes

---

- Robotic technology advancement is a key objective of the R2C2. Competitors are invited to communicate directly with R2C2 regarding any rule that restricts their ability to demonstrate technical achievement and innovative solutions.
- The R2C2 has the authority to modify the rules at any time. Rules may be modified for many reasons, including accommodation of a promising technical approach that would have been prohibited by the rules.
- R2C2 will communicate any modifications to the rules through the competitor SharePoint.
- The R2C2 may revise the schedule at any time and interpret the rules in any manner to best meet R2C2's objectives. The R2C2's decisions are based on a number of factors such as fairness, safety, statutes, program goals, environmental protection, and efficient operations.

# Rules Doc & FAQ

---

- There are two primary rules documents:
  - R2C2 Competition Rules
  - R2C2 Competition Rules FAQ
- Questions regarding rules will be published in the FAQ as they are answered
- These will be evolving documents
- The latest versions will always be posted on the Competitor SharePoint



# Industry Standard Objects

Industry Standard Object (ISO):  
pipe sections commonly used in  
evaluating geophysical sensors



Item	Nominal Pipe Size	Outside Diameter	Length	Part Number <sup>1</sup>	ASTM Specification
Small ISO	1"	1.315" (33 mm)	4" (102 mm)	44615K466	A53/A773
Medium ISO	2"	2.375" (60 mm)	8" (204 mm)	44615K529	A53/A773
Large ISO	4"	4.500" (115 mm)	12" (306 mm)	44615K137	A53/A773

<sup>1</sup> Part number from the McMaster-Carr catalog.

# Questions?